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CIRCULAR No. 508 DECEMBER 1938
UNITED STATES DEPARTMENT OF AGRICULTURE
WASHINGTON, D. C.

THE COMPARATIVE ATTRACTIVENESS OF VARIOUS SMALL GRAINS TO THE CHINCH BUG

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INTRODUCTION

It has often been suggested that infestations of chinch bugs (*Blissus leucopterus* (Say)) might be reduced by discontinuing the sowing of the small grains most attractive to the bugs or by limiting their use to trap crops in which these insects could be concentrated and then destroyed before they migrated to adjacent corn. To obtain definite information on the possible effectiveness of these practices, extensive field studies to determine the comparative attractiveness of the different small grains to chinch bugs leaving hibernation in the spring were made in northern Illinois during the spring and early-summer seasons of 1934, 1935, and 1936 and in west-central Illinois in 1937. Owing to the presence of much small grain in all the districts included in these studies, there was no opportunity to determine what effect the elimination of all small grains from a locality might have on the chinch bug situation.

METHOD OF STUDY

Periodical field counts were made in selected small-grain areas, each approximately 1 mile square, near Aurora, Ill., in 1934; near Sterling,

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[1] The writers wish to express their thanks to C. M. Packard, formerly in charge of the La Fayette, Ind., laboratory of the Bureau of Entomology and Plant Quarantine, for assistance in the direction of the work reported in this circular, to L. H. Shropshire and J. H. Bigger, of the Illinois Natural History Survey, and to the various farm advisers and the several hundred Illinois farmers in the counties in which the work was done.

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Ill., in 1935 and 1936; and near Taylorville, Ill., in 1937. By means of these counts estimates were made of the chinch bug populations in the various small grains as a result of (1) direct migration of overwintered adults from hibernation quarters, (2) interfield migration of these adults from one small grain to another, and (3) infestation by the first-generation nymphs.

In 1934 each test area was composed, so far as small grains were concerned, of rye, winter wheat, and spring oat fields and one centrally located spring wheat or spring barley field. A check area of rye, winter wheat, and spring oats, but no spring wheat or spring barley, was located near each test area.

In 1935 and 1936 each test area consisted of spring oat fields only, except for a centrally located field of rye, winter wheat, spring wheat, or spring barley. The check areas that year were made up of spring oat fields only.

In 1937, owing to the great variety of grains in the vicinity of Taylorville, areas containing as many kinds of small grains as could be found growing close together were selected. These areas, although approximately 1 mile square, varied somewhat in size. Each area contained four or five of the following kinds of grain: Rye, winter wheat, spring wheat, winter barley, spring barley, winter oats, and spring oats.

All rye fields included in these observations were fall-sown. The number of fields and the acreages of the different grains are shown in table 1.

TABLE 1.—*Total number of fields and acreage of each kind of grain under observation for attractiveness to the chinch bug, northern Illinois, 1934–37*

Grain	Fields in—				Total area in—			
	1934	1935	1936	1937	1934	1935	1936	1937
	Number	*Number*	*Number*	*Number*	*Acres*	*Acres*	*Acres*	*Acres*
Rye	13	5	10	19	132	85	86	219
Spring wheat	3	2	2	8	30	27	11	260
Winter wheat	22	8	12	51	458	172	221	1, 151
Spring barley	7	3	3	9	147	39	37	85
Winter barley	--------	--------	--------	15	--------	--------	--------	149
Spring oats	74	78	86	46	1, 915	1, 458	1, 532	582
Winter oats	--------	--------	--------	4	--------	--------	--------	9
Mixed spring wheat and oats	1	--------	--------	--------	10	--------	--------	--------
Total	120	96	113	152	2, 692	1, 781	1, 887	2, 455

In 1934 and 1935 the counts were made from early in the spring until the end of the small-grain season late in July. Owing to the light infestation in 1936, the observations near Sterling were discontinued on June 10 of that year. During the following 10 days, however, additional counts were made in five localities near Macomb and Carthage, in west-central Illinois, where there was a moderately heavy chinch bug infestation, consisting chiefly of first-brood nymphs, since most of the overwintered adults had already died or left the fields. Table 2 shows the small grains in which these supplementary counts were made, the number of fields of each, and the acreages.

Table 2.—*Total number of fields and acreage of each kind of grain under observation for attractiveness to the chinch bug, vicinity of Macomb and Carthage, Ill., June 11 to 20, 1936*[1]

Grain	Fields	Total area	Grain	Fields	Total area
	Number	*Acres*		*Number*	*Acres*
Rye	5	64.0	Spring oats	14	277.0
Winter wheat	19	290.0			
Spring barley	1	8.0	Total	40	639.1
Winter barley	1	.1			

[1] Observations supplementary to those included in table 1.

Infestations of adult chinch bugs were based on the number of bugs per linear foot of drill row and were estimated every week or 10 days by averaging the numbers present in several counts made in representative parts of the fields in both test and check areas. In 1934 five to eight linear-foot counts and in 1935, 1936, and 1937 nine linear-foot counts were made in each field. Nymphal infestations were estimated in a similar manner except that, owing to the impossibility of making exact counts, the numbers present were counted roughly and classified as follows: Slight, 0 to 24; moderate, 25 to 75; abundant, above 75.

RESULTS

Table 3 summarizes the maximum counts of overwintered adult chinch bugs in all areas at the completion of spring migration. These counts were made at Aurora, May 11 to 26, 1934; at Sterling, May 31 to June 12, 1935, and May 15 to 25, 1936; and at Taylorville, May 15 to June 4, 1937. This table shows the comparative numbers of bugs migrating from hibernation to each kind of grain each year. It also shows the 4-year average for the various small grains, the average for each year being given equal weight in the 4-year average for each grain.

Table 3.—*Original infestations of overwintered adult chinch bugs in the different small grains, northern Illinois, 1934–37*

Grain	Average number of bugs per linear foot of drill row in—					Grain	Average number of bugs per linear foot of drill row in—				
	1934	1935	1936	1937	4-year average		1934	1935	1936	1937	4-year average
Rye	43	13	1.2	7.0	16.1	Winter barley	------	------	------	4.1	--------
Spring wheat	17	13	.8	1.0	8.0	Spring oats	2	2	.04	.3	1.1
Winter wheat	42	12	.6	4.0	14.7	Winter oats	------	------	------	.2	--------
Spring barley	20	23	2.5	4.4	12.5						

FACTORS INFLUENCING ATTRACTIVENESS

The range in weather conditions over the period 1934–37, especially from the hot, dry spring of 1934 to the cool, wet one of 1935, was about as wide as is ever likely to occur in localities where the chinch bug is abundant.

The grains showed considerable variation in attractiveness from year to year, rye being the most attractive during two seasons and spring barley the other two. Both pastured and unpastured rye fields were included in the study. Since infestations in pastured fields, owing to their sparser growth, were much greater than in unpastured fields, the averages for rye shown in table 3 are higher than such averages would be for unpastured rye only. The 4-year averages indicate that rye, winter wheat, and spring barley ranked fairly close together in attractiveness to chinch bugs. Winter barley and winter oats were available in 1937 only, but observations for the 1 year indicate that the attractiveness of these grains is about the same as that of spring barley and spring oats.

Although chinch bugs appear to prefer certain small grains to others, this preference is not constant. Variations in moisture and temperature conditions from year to year greatly affected the growth of the different grains and consequently determined which were in a condition most attractive to chinch bugs migrating from winter quarters. The discussion which follows mentions the various factors influencing the attractiveness of these grains to chinch bugs.

In 1934 infestations were extremely severe, and the spring was hot and dry, with little rain throughout the growing season for small grains. In these circumstances rye and winter wheat proved most attractive because of the more abundant food and shade they offered as compared with the spring grains of puny growth. Also, the cracked ground in these fields offered additional shelter from the heat and caused unusually heavy oviposition on the roots. These factors evidently were responsible for the heavier initial infestation in the winter than in the spring grains. Later in the season, as the spring grains developed, and the winter wheat and rye were prematurely killed by nymphs of the first brood or became too rank in growth to suit the surviving overwintered adults, the infestation in winter grains was reduced by interfield flights, mostly to adjacent spring oats but also to corn, where they completed feeding and oviposition. Considerable initial infestation, however, was found in spring barley and spring wheat, and to a lesser degree in spring oats, despite their puny growth. In some fields of spring barley and spring wheat this infestation was sufficiently heavy to destroy the crop, and in others newly hatched nymphs of the first brood killed any plants that survived the first attack. The total infestation destroyed most of the spring barley and spring wheat.

In 1935 infestation at the beginning of the season was unusually heavy, but was greatly reduced by the cold, wet weather of the spring and early summer. Migration from winter quarters was delayed so that by the time the bugs appeared much of the winter wheat and rye was too rank in growth to be attractive to them. The infestation in these grains was more nearly typical of the average season than that of 1934 and was confined largely to the thinner, poorer stands, which offered desirable locations for oviposition around the bases of the plants as well as fairly good protection against the frequent rains. Spring barley, however, and to a lesser degree spring wheat, proved very attractive during the spring flight, as the plants were then beginning to stool and provide food and shelter from rain. The infestation in these grains was more generally distributed, but the average populations were as high as those for rye and winter wheat. The results for this year show the hazard of sowing spring barley and spring wheat in areas where large numbers of chinch bugs are known to be hibernating. Oats were in general less attractive, although spots of rather heavy initial infestations were found in some fields. Later in the season chinch bug abundance in this grain was increased by interfield flight of overwintered bugs from winter wheat and rye, but to a lesser degree than in 1934. In a few instances first-brood infestation developed in corn as a result of interfield migration of overwintered bugs from the winter grains.

In 1936 alternate periods of warm, dry weather and cool, wet weather caused migration from winter quarters to be slow and intermittent. The relative infestation of the various small grains was similar to that of 1935, but owing to the heavy mortality during the preceding winter the general infestation was relatively light.

In 1937 the chinch bug was moderately abundant where the studies were conducted. The spring was cool, with frequent rains, and in general migration was delayed until May. Most of the earlier migrants settled in the winter grains. The spring grains were less attractive, evidently because they had made such poor growth early in the season that they offered little protection from rain, but before the end of the migration period they were in a more attractive condition owing to their rapid growth. An unusual factor affecting chinch bug infestation later in the season was an outbreak of armyworms (*Cirphis unipuncta* (Haw.)) during the last of May and the early part of June. In some winter grain fields the armyworm larvae stripped the ranker growths and made the stands favorable to chinch bugs, especially for development of first-brood nymphs.

SMALL GRAINS AS TRAP CROPS

It was thought that observations on mile-square areas containing a central field of a small grain more attractive than oats surrounded within a half-mile radius by oatfields only might give some indication as to the value of trap-crop fields about a mile apart in all directions throughout a community. Attempts were made to find such areas, but this was almost impossible, as one or two fields of other small grains were usually present near the edge of the area. Nevertheless, the data obtained indicate clearly that no small grain is sufficiently more attractive than the others to be considered a dependable trap or concentration crop. Table 4 shows the average infestation in the central grainfields of the several areas, in the surrounding oatfields within a half-mile radius of these central fields, and in nearby check areas containing oats only. The data for 1934 and 1937 could not be used in this comparison because most of the areas observed in those years contained other grains besides oats.

TABLE 4.—*Infestations by overwintered chinch bugs in oat areas with and without central fields of more attractive small grains, northern Illinois, 1935–36*

Date	Oat areas with central field of other grain					Oat areas without central field of other grain			
	Central field		Oat fields			Date	Average number of bugs per linear foot of drill row		
			Average number of bugs per linear foot of drill row						
	Kind	Average number of bugs per linear foot of drill row	Average of all fields	Minimum	Maximum		Average of all fields	Minimum	Maximum
June 1, 1935	Winter wheat	8.3	1.10	0.1	3.3	May 31, 1935	1.40	0.3	2.4
June 4, 1935	Rye	7.6	1.00	.2	1.7	June 4, 1935	1.10	.3	2.0
June 5, 1935	Spring wheat	5.8	.50	.0	1.2	June 8, 1935	1.70	.1	2.7
June 7, 1935	Spring barley	28.7	1.90	.1	4.4	do	3.50	.1	6.4
June 12, 1935	Winter wheat	.9	.60	.0	2.7	June 14, 1935	3.30	.6	6.7
May 15, 1936	Spring barley	3.1	.03	.0	.2	May 16, 1936	.10	.0	.3
May 19, 1936	Spring wheat	.1	.01	.0	.1	May 19, 1936	.10	.0	.7
May 26, 1936	Rye	.0	.02	.0	.1	May 27, 1936	.01	.0	.1
May 27, 1936	Winter wheat	.2	.04	.0	.2	June 3, 1936	.16	.0	1.2
	Average	6.1	.58				1.26		

Oats in the immediate vicinity of the more attractive small grains were very slightly less infested than oats at some distance from such grains. It is evident that the presence of the more attractive grains did not prevent the infestation of the oats. Furthermore, in the absence of the more attractive grains the bugs evidently settled in the oats to a considerable extent instead of searching for other grains elsewhere. Some of the oatfields in areas with a central field of a more attractive grain developed heavy infestations, which sometimes equaled the infestation in the central field. These oatfields had thin stands or were attractive to the bugs in other ways and were often near or adjoining the central field. Where rank growth made some of the winter wheat or rye less favorable to the bugs, the infestation in parts of the surrounding oatfields greatly exceeded that in the more attractive grain.

These studies revealed another reason why trap crops of the more attractive grains would be ineffective in concentrating the bugs. In some cases the overwintered adults left the winter wheat and rye when these grains developed rank, thick growth, and migrated to oats and even to corn, which became infested by their progeny. There is no certainty, therefore, that the overwintered bugs will stay and breed exclusively in the more attractive small grains, even though they settle in them when first emerging from hibernation.

In 1934 many farmers used their drought-ruined small-grain fields as trap crops. Where the infested fields were plowed under and harrowed thoroughly at the right time to destroy the first-brood nymphs before they were large enough to migrate readily, severe infestation of adjacent corn was prevented. Other attempts were unsuccessful because of the difficulty of selecting a time for the destruction of the grains when the majority of the bugs were too small to survive the cultural operations. Where adults or nearly grown nymphs were abundant, it was difficult or impossible to destroy them before they could reach the corn, and the use of barriers was necessary.

Although under some conditions small grains sown for other purposes may be utilized as trap crops, special trap-crop plantings are impractical. Not only are they unlikely to contain a sufficient concentration of bugs, but in the event of such concentration the farmer would probably omit or slight the cultural operations or the use of barriers. Furthermore, any gain through control of the bugs by trap-cropping would be offset by the loss of productive acreage, the expense of sowing and destroying the crop, and the limitation to nonsusceptible crops for replanting trap-crop areas.

SUMMARY AND CONCLUSIONS

Observations made in northern Illinois during the spring and early-summer seasons of 1934, 1935, and 1936 and in west-central Illinois in 1937 show that the preferences of chinch bugs migrating from winter quarters vary with the weather during the spring and with the growth of the small grains. In 1934 rye and winter wheat were the crops preferred, but in 1935 spring barley ranked highest in attractiveness, although spring wheat was heavily infested, as were also rye and winter wheat. In 1936 the relative infestation in the different grains was similar to that of 1935. In 1937 rye averaged highest, with winter wheat, spring barley, and winter barley about equally infested, and spring wheat decidedly lower in general infestation. Oats were least attractive throughout the study, although some fields showed spots of heavy infestation, even in areas where the preferred grains were present. In short, no small grain was so unattractive to the bugs that exclusive planting of it could be depended on to prevent severe spring infestations by overwintered adults, development of their progeny in large numbers, and subsequent migrations to adjacent corn.

No small grain was sufficiently more attractive than the others to be considered a dependable trap or concentration crop.

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U. S. GOVERNMENT PRINTING OFFICE: 1938

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